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Devoted to the Philosophy of Science

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THE JOURNAL OF PHILOSOPHY

THE LOGIC OF MEASUREMENT

IT is perhaps not strange that most of the problems in the philosophy of science have been discovered by philosophers rather than by scientists. Perspective is not gained from within. Immersion in the details of collecting, arranging, and organizing data, formulating hypotheses and checking and rechecking by experiment, are not conducive to the attainment of a broad vision of the scientific method as a whole. To be concerned with the manipulation of numbers does not lead one readily to ask questions as to the ultimate nature of number. When LaPlace wrote his book on the theory of the heavens he did not need the hypothesis of God. The scientist is too much concerned with getting somewhere to stop and ask how he gets there.

All this is, of course, rightly so. But it has most important consequences. For there arises necessarily a large group of problems which, so to speak, know not where to lay their heads. They are not scientific for they are no concern of the scientist; yet they are not philosophical, for their content is essentially scientific. Who, then, is to be the final arbiter in case dispute arises as to the legitimacy of such problems? Is it to be the scientist who will probably fail to see their philosophical bearing, or the philosopher who will probably misconstrue their scientific significance? One is reminded of Poincaré's remark *à propos* the law of error: "All the world believes it firmly because the mathematicians imagine that it is a fact of observation, and the observers that it is a theorem of mathematics."

For this reason I am somewhat hesitant about suggesting my problem, for I am not sure that it *is* a problem. Both the scientists and the philosophers may legitimately disclaim any responsibility for its solution. Yet I venture to suggest with appropriate modesty that it is not just pure nonsense.

Put as simply as possible, the problem is this: Why measure? More explicitly: What is the informative value of measurement? What does the process of attaching a number to a quality tell us about its character? What is the logical value of the reduction of quality to quantity?

In the first place, let me insist that I am not in any sense calling into question the legitimacy of measurement. This would indeed

be an inopportune moment in the history of science even to hint at the ineffectiveness of measurement. It would seem, rather, that with the adoption of quantitative methods science is at last really coming to its own. Many would insist that when man first began to measure, science was born. Whitehead bemoans the fact that measurement was so late in appearing in the history of science. "The practical counsel to be derived from Pythagoras," he remarks in his *Science and the Modern World,* "is to measure, and thus to express quality in terms of numerically determined quantity. . . . If only the schoolmen had measured instead of classifying, how much they might have learnt!"[1] "The predominance of physics is due," says Norman Campbell, "to its consistent determination to introduce measurement into its discussions at the very earliest stage."[2]

In the second place, let me de-limit my field to exclude all technological questions. This will enable me to avoid all of the problems which have to do with the actual manipulatory activities involved in measurement. To exclude such problems from consideration is not to deny their reality. It is rather to acknowledge that their importance is too great to warrant the superficial treatment which I shall give the problem. Bridgman has well emphasized the importance of these questions when he suggests that in a certain sense the very meaning of the term "measurement" is dependent upon what we happen to be measuring.

With these two significant limitations, then, let me turn to my problem. Why measure? The solution which has been heard most commonly in recent years is somewhat as follows. We measure because quantitative concepts give us an insight into the character of the world which could not possibly be gained by purely qualitative notions. Quantity is, in fact, fundamentally more rational than quality. Qualities are given as stubborn, brute facts, to be felt or experienced, but not to be comprehended in their given character. A quality is not understood until it is measured. If it can be measured directly, the result can be achieved immediately; if it can not be measured directly, it must be measured indirectly by correlation with a quality which can be measured; if there is no such quality, then recourse must be had to a hypothetical or fictional entity, itself quantitatively and supposedly in direct variation with the given quality. Laws, furthermore, which express correlations between two qualities, are not properly laws at all until the qualitative correlations have been replaced by functional relationships of a mathematical kind. Quantity is the key which unlocks reality.

[1] P. 41.

[2] *Physics, the Elements,* p. 33.

Now as a methodological postulate this can hardly be criticized. But as is often the case in science, a methodological postulate is given the status of a metaphysical judgment. The quantitative aspects of the world are soon looked upon as representative of its essential nature. To explain qualities is to explain them away. To understand them is to be convinced that they are mere appearances. To rationalize them is to construct a system in which they do not function at all as genuine elements. To talk about them is to talk about them vicariously. To grasp them is to realize that they can not be grasped.

This metaphysical conclusion may or may not follow from the above postulate; with its truth or its relationship to that postulate I shall not be concerned. But should we be able to cast doubt upon the validity of the postulate, we should also to that extent undermine the derivative metaphysical position.

Let me state in the clearest manner possible the truth which is contained in this postulate. By the correlation of quantities with qualities, the qualitative system is replaced by a quantitative system whose integrative possibilities are much greater than those of the qualitative system and which, accordingly, contributes to that qualitative system a high degree of rationality. This is based upon the commonly recognized fact that whereas every quantitative relation presupposes a qualitative relation, many qualitative relations represent, so to speak, a whole sheaf of quantitative relations. The logical relations between two qualitative concepts are based either upon the mere presence or absence of the qualities in an occurrent, or a class of occurrents, or upon the resemblance or difference obtaining between the concepts. As soon as quantity is introduced, presence and absence become replaced by degree of presence and degree of absence, i.e., by degree of intensive manifestation, and resemblance and difference become replaced by degree of resemblance and degree of difference. Now the introduction of numbers involves the admission into the system of qualities of a relation not possessed in general by qualities, a relation which permits one element of the system to be derived from another element of the system by an operation. Hence when qualities are represented by measured values, the qualities take on with relation to one another the relations of the respective measured values. Thus the qualities become derivable from one another by operations. This gives the correlations of existence much less of the character of brute facts, for it is now possible to see in a sense why they are as they are. The relation of species to genus and of species to coördinate species becomes interpretable in terms of the relation of value to variable and of one value to another. For example, the qualitative relations between, say, red,

green, and blue, and between any one of these and the abstract notion of color, are, as purely qualitative relations, somewhat in the nature of surds whose reality we must recognize, but whose character we can not penetrate. One may say in a vague sort of way that the shades differ from one another in that each possesses the same indefinite relation to the abstract notion of color. When quantitative values representing wave lengths are employed to designate the shades, the nature of the difference between the shades is seen to be of the same kind as that between two numbers, and the nature of the relation of any shade to the abstract notion of color is seen to be of the same kind as that between any number, as a value, and number in general as a variable. Furthermore, and this, after all, constitutes the essential advantage of a quantitative system over a qualitative one, the relational possibilities of the qualitative system are enormously increased by virtue of the extension of the number system to include zero values, negative values, and infinite values, to mention only a few. It then becomes possible to recognize qualitative relations not previously known to obtain. For example, a circle and a polygon may be shown to resemble one another by virtue of the fact that the circle may be derived from the polygon through the increase to infinity of the number of the sides. So in the same way a straight line may be shown to be a curved line of zero curvature, parallel lines may be shown to be lines which meet at infinity, etc. Thus in general the introduction of quantitative methods permits the substitution of relations of quantitative dependence for relations of qualitative independence or of loose qualitative dependence, and of specific quantitative dependence for relations of general qualitative dependence. Accordingly, a high degree of systematization and integration replaces a low degree, and the aims of rationality are to that extent achieved.

Such, I think, is the essential content of the postulate, and I hardly see how one could disagree with it. But there is commonly claimed for the postulate more than is thus revealed upon the surface. For this reason I wish to examine it further. I shall attempt to point out two limitations which must be put upon the interpretation, in order to determine more precisely its explanatory value and to prevent certain unjustifiable metaphysical implications from being drawn. These limitations have to do, in the first place, with the claim that quantity is logically more basic than quality, and, in the second place, with the claim that a quantitative system can in any sense be representative of a qualitative system.

With regard to the first claim, that quantity is logically more basic than quality, there are several considerations. In the first place, what is one to mean by the phrase "logically more basic"?

In the system of *Principia Mathematica* quantitative notions are introduced late in the derivation; qualitative notions are presumably logically more basic because they constitute the content of the more elementary theorems. Thus by "logically more basic" one can not mean "nearer in a deductive system to the primitive propositions." Nor can one mean by the phrase, "more abstract." This would presume that quantity is more general than quality and that quality is definable as a species of quantity possessing a certain differentiating property. The fact seems to be that the reverse is true. Quantity is less abstract than quality because it is a species of quality whose differentiating property may be pointed out. Thus there are quantitative and non-quantitative qualities. Whenever the species of a quality may be arranged into a series by virtue of an asymmetrical, transitive, connected relation which is capable of being interpreted as "greater than," this quality may also be spoken of as a quantity. Thus a quality is also a quantity when certain conditions, which may be specified, are fulfilled. All quantities are qualities, but not all qualities are quantities.

But, in the second place, there is the much more obvious fact that every quantity is a quantity of something. Quantities are not mere numbers but lengths, areas, volumes, durations, velocities, masses, etc. The representation of quantities by numbers tends to obscure this fact, for in the numerical representation we often lose sight of the fact that, after all, there is a unit involved, and that it is the qualitative character of this unit which makes our measurement truly representative. Thus when we attach a number to a length we do not dispose of the length once for all by replacing it by a number; we substitute for it a numbered length, and the problem remains. The same situation prevails, though in a slightly different manner, in those cases where we do not measure directly. To measure the quantity of heat by the length of a column of mercury is not to reduce quality to quantity, but merely to substitute for a quality to which numbers can not be readily attached another quality to which they can. The "reduction" of heat to molecular motion is, in principle, the same; for motion is still a quality, i.e., something qualitatively distinct from, say, angular spread.

In the third place one may go even further. For is not number, which is presumably the most quantitative of all quantities, itself a quality? That it is always a property of a class rather than of a single object gives it no character of uniqueness, for there are many such properties which would be characterized as qualitative, e.g., the properties of being unified or disunified, systematic or unsystematic, ordered or unordered. The fact seems to be that number is one of the given properties of things just as color and sound.

Certainly that which distinguishes number from color and sound can not itself be a quantitative factor. May not one insist also that that which distinguishes twoness from threeness, although it is a quantitative factor, can not be purely such? Numbers lend themselves so readily to serial arrangement that we are inclined to lose sight of their purely qualitative character. It seems clear on inspection that twoness, threeness, fiveness are basically qualitatively distinct species of the genus number, distinguishable from one another in the same sort of way that red and green, or bitter and sour are distinguishable.

The objection which one is tempted to make at this point is something like the following: But do we not institute measurement precisely in order that the mysterious relationship between red and green may be made intelligible by substituting for each of them a number representing its wave length, and thus showing that the relation between red and green is the same as that between two numbers, and that the relation between red and green, respectively, and the general notion of color is the same as that between two specific values of a variable and the variable itself?

Such an objection begs the very question at issue. Since the relation of two numbers to one another is simply the relation of one of two coördinate species to the other, and since the relation of any value of a variable to that variable is merely an instance of the species-genus relationship, it is hard to see why talking in terms of numbers helps us to understand colors. We simply have two qualitative systems which are structurally similar; if a relation in one system is mysterious, it will be equally so in the other. Apart entirely from ordering relationship, it seems that the qualitative difference between twoness and threeness is just as ultimate and inexplicable as the qualitative relation between redness and greenness, and although we *seem* to be able to derive twoness and threeness from number in general as a matrix, we are actually able to do this with no more success than we are able to derive redness and greenness from color.

The second general claim of the postulate of measurement is that quantity is a true representative or indication of quality, i.e., that in the act of measuring a range of qualities there is constructed a quantitative substitute for it, which substitute so accurately represents the original as to make unnecessary any further reference to it.

While agreeing, as before, with the substantial character of this claim, I feel an urgent need to suggest certain limitations which should be put upon its interpretation. The first is a word of caution with regard to the substitutional character of these systems. It

must be remembered that the resemblance of the quantitative system to the qualitative system is one merely of a structural character of the most general sort. Thus one can not be sure that any specific relation of the quantitative system is going to possess a counterpart in the qualitative system. In other words if we suppose that we can do everything with qualities which we can do with their measured values we are going to get into all sorts of absurdities, such as supposing that colors may be multiplied together, or tastes divided by one another. It is true that the analysis of the quantitative system frequently suggests valuable hypotheses to be tested with reference to the qualitative system, but these must be considered as mere hypotheses and subjected to the usual tests.

The second limitation is a reminder that however great may be the structural similarity of the two systems, in general as we pass from the qualitative system to the quantitative system we lose the essential *quale* of the quality measured. Where the measurement is of a very direct sort this need not be true, provided we do not lose sight of the unit. But in the less direct sorts of measurement, where we correlate colors with wave lengths, and tones with vibrations, and heat with columns of mercury, it is clearly absurd to suppose that the measured value in any sense replaces the quality measured. When qualities are measured they are not explained away. There is thus no reason to suppose that the reduction of heat to quantitative terms makes it unreal or subjective or in any way removes it from the realm of empirically given entities. Quality, apparently, is closer to sentiency, just as quantity is closer to rationality. But there seems to be no reason why sentiency should be absorbed in rationality.

The third limitation is the general incapacity of a quantitative system to represent dichotomous divisions, i.e., to handle two-valued systems. Where qualities manifest themselves not by degree but by complete presence or complete absence, there can be no quantitative representation. Thus it is impossible to show quantitatively how two qualities can be at the same time similar because species of the same genus and yet contradictory because implying contradictory differentia. Bogoslovsky's attempt to explain qualitative differences in terms of a principle of quantitative indices applies to divisions which are only *apparently* dichotomous and is utterly futile when forced upon genuine dichotomous divisions.

In the fourth place one must insist that measurement is in many cases an affair of so artificial a character, that one is presuming a great deal to suppose that a knowledge of the quantitative system conveys any essential information with regard to the qualitative system. Many qualities may be ordered as intensive quantities, and

then more or less arbitrarily correlated with the system of ordinal numbers. As a result the system of qualities may be supposed to take on the relationships of the ordinal numbers. One of the best examples of this sort of thing is the measurement of hardness upon the basis of the asymmetric, transitive, connected relation "scratches." When the serial arrangement has been completed, one member of the series is chosen in a completely arbitrary manner as the standard of hardness, and the correlation of the ordinal numbers begins at this point. It is easily seen that the numbers represent the qualities not inherently but only in the sense that they locate the qualities in a graded series of similar qualities. Thus the informational value of such a representation is dependent upon the choice of a standard of value, the compactness of the series, the regularity of the intervals between adjacent members, and the terminating members of the series. And in any case the only structural relations which may be transferred from the system of quantities to the system of qualities are the ordinal relations. These are definitely more limited in scope than the cardinal relations. This sort of measurement is coming into vogue more and more in recent years in extra-scientific fields. One can not order potatoes in a produce market without being asked whether one wants grade A, B, or C; nor can one buy a can of peas without deciding whether to take grade 3 or grade 4.

In the fifth place, and this limitation seems to me to go right to the heart of the matter, the more highly integrative character of a quantitative system is brought about in many cases only through the introduction into that system of complex, non-descriptive, fictional concepts or constructs. Such notions have clearly lost touch with reality; thus their representative character has been sacrificed to their integrative character, and though their insertion in a conceptual system contributes to the rationality of that system, the sense in which the system may be said to be "about" reality becomes more and more strained as their number increases. The best examples of this sort of thing are found in mathematics, though the same tendencies are found in all sciences which are beginning to take on a highly integrative character. One of the most common of the fictional activities is approximately as follows. Given a quality which is subject to a quantitative variation within certain empirically determined limits, suppose the quality to take on a value outside of these limits; what propositions may then be asserted about it? It is clear that no existential propositions can be asserted with reference to it, and it is equally obvious that all characterizing propositions will be conjectural because based on loose analogies and unproved assumptions of continuity. This is the status of perfect

levers, and ideal gases, of mathematical points, lines, and planes, of completely isolated human beings, perfect human beings, of the various utopias and perfect economic cities, etc. Such notions can hardly be spoken of as descriptive in any commonly accepted meaning of the term; thus one may say that with the introduction of quantitative methods reality as experienced is being essentially lost sight of. To be sure, this is only half of the story. For with the loss in descriptive character there is an immense gain in the integrative character of the knowledge. With the increase in ideal notions comes also a decrease in gaps in the total body of propositions constituting the science; independent elements are related by the insertion of ideal members participating in the characters of both; in many cases actual members of the system are shown to be identifiable with ideal extensions of other members as in the definition of a circle as a polygon of an infinite number of sides; relations of independence between propositions become replaced by relations of compatibility, and relations of compatibility by relations of implication. The result is a system of highly integrated elements, eminently satisfactory so far as our rational demands are concerned, but lacking in the single descriptive character which was the virtue of the original qualitative concepts. Thus we have here a factor which imposes an essential limitation upon the interpretation of the proposition that in measurement we construct a quantitative substitute for a qualitative system. The quantitative system is not only more highly integrated than the qualitative one, but it is made up essentially of idealized and simplified counterparts which can not in the nature of the case adequately represent the simple qualities.

One might easily prolong the argument, but I stop with the mere enumeration of certain further limitations, such as our inability to solve mathematical problems beyond a certain degree of complexity so that the mathematization of qualities may involve only a pseudo rationality. Again there are all of the difficulties associated with measurements as they are actually carried on, the fact of the fluctuation of values so that we are compelled to be satisfied with averages, means, modes, etc., the fact that all measurement rests ultimately upon a judgment of sense either in the reading of the recording instruments or in the construction of the recording instruments in the first place, etc., etc.

My thesis has, I hope, been made clear. I have not tried to deny the adequacy or the efficacy of measurement either upon theoretical or upon practical grounds. I have tried to show, rather, that when we do measure we must not claim for our results more than is justified by the actual character of the measurement process. More

specifically we must not suppose either that we have gotten rid of quality or that we have constructed a genuinely representative image of quality.

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WHITEHEAD'S CONCEPT OF PROCESS: A FEW CRITICAL REMARKS[1]

1. Whitehead's philosophy of organism is built on the assumption that the most significant feature about the world's cosmology is the fact of becoming. There is not a corner in the universe, where it does not take place; nor is there a day, when it rests. Wherever it is, there is life, experience, change, action. Behind it lies the cinder of events that no longer happen; in front—there is nothing yet. Indeed, in becoming, events generate their offspring, the present. Its contents are not fixed, but stride over dates: for becoming is not time, but produces time. The distinction among the past, present, and future should not, therefore, be regarded as intrinsic to time, but rather as descriptive of incidental relationship between facts and the process. The truth is that the present of this series is not identical with becoming, but only with the contents of becoming: as they change, the present changes, too. It seems to follow that process is prior to time (as well as to space) and that extension constitutes the potential order in which becoming performs its creative advance into novelty. Indeed, in asking the question "whether time is to be found in nature or nature is to be found in time" (*CN*, 65), Whitehead definitely chooses the former alternative. "Genetic passage from phase to phase is not," he says, "in physical time: the exactly converse point of view expresses the relationship of concrescence to physical time. It can be put shortly by saying, that physical time expresses some features of the growth, but *not* the growth of the features" (*PR*, 434). Whitehead thus joins Leibniz, in the latter's opposition to Newton's "receptacle" doctrine of time and space, according to whom "bits of space and time were conceived as being as actual as anything else, and as being 'occupied' by other actualities which were bits of matter" (*PR*, 109).

2. It seems to me that, in having accepted the logical priority of

[1] I shall use the following abbreviations for the titles of A. N. Whitehead's works: *E* for *An Inquiry Concerning the Principles of Natural Knowledge* (1919); *CN* for *The Concept of Nature* (1920); *R* for *The Principle of Relativity* (1922); *PR* for *Process and Reality* (1929); *A* for *Adventures of Ideas* (1933).

process to space-time, Whitehead chose a precarious intellectual enterprise. As another of our contemporaries recently remarked,[2] "the word 'potentially' is a dangerous one in philosophy. It has often been used to disguise or evade the problem of change, which is not an easy one." Now, we should not forget that in the spiritualistic pluralism of Leibniz the "order of succession" and the "order of coexistence" were essentially ideal orders; and that objects and events were data of subjective experience for which perceptual space and time served as the fields of potential existence. But, whereas the monads of the German thinker, having no "windows," did not interact but spontaneously changed following the principle of pre-established harmony, the events of Whitehead are situated in extension, a physical and real spatio-temporal order, which largely determines the form and results of their interaction. The difference in these two positions is quite important, piling upon the Cambridge-Harvard thinker considerably greater difficulties in his exposition of the doctrine of potential extension than Leibniz ever had to face. To be sure, it is perfectly natural for human beings to limit actuality to the data of perceptual and emotional experience, that is to say, to everything that lies within the shifting boundaries of the advancing present. But it is no less natural to believe also that space falls within these boundaries and that, consequently, it should be identified with the field of the actual rather than with that of the potential. However, a thinker of our days finds himself in a quandary in this respect. His memory is still ringing with the news concerning that great intellectual revolution which was achieved in reorganizing our conceptual world through the special theory of relativity. He well understands that in deciding to regard space as actual and time, with the exception of the present moment, as potential he commits himself to a serious departure from the gains which the notion of space-time yielded to us, or perhaps even to a return to no longer tenable doctrines of the nineteenth century. Whitehead, himself an important contributor to the theory of relativity, concedes that all four physical dimensions are essentially similar and, in fact, starts building his philosophical system with postulating the notion of the quadridimensional event-particle. He is thus forced to regard extension, and also time and space, as abstractions from it, either as potential in every respect or as actual, before, now, and afterward. He chose, as we know, the former alternative. Yet the undertaking to bring his ideas into coherence under these conditions seems to have been so great that he manifests certain embarrassment in denying the actuality of present space.

[2] Inge, W. R., *Outspoken Essays* (Second Series), 9.

3. Let us, then, try to comprehend the nature of Whitehead's difficulty. First of all, what exactly does he understand by the term "actual"? Negatively, it is that which is "divested of all possibility" (*E*, 61); positively, "it is what does become in nature" (*ibid.*). In his interpretation, extension, on the whole, does not satisfy these conditions. Indeed, it can not be actual, for, as Whitehead clearly points out, extension is continuous, whereas "actuality is incurably atomic" (*PR*, 95). Even durations, which are present slabs of extension, possess no atomic structure (*CN*, 59) and extend over neighboring durations, thus having no maximum or minimum measurement. What, in fact, can be less ambiguous than a statement to the effect that the extensive continuum "is in itself the potentiality for division" and that "an actual entity effects the division" (*PR*, 104)? But the solution of our problem is not quite so simple. We recall, indeed, that Whitehead himself describes a duration as a complete and inclusive event (*CN*, 186), not making it sufficiently clear in what respect and when a duration partakes of the qualities of event, which is atomic, and of the qualities of extension, which is continuous. Similarly, time is conceived as continuous as well as atomic. It seems that, in regard to the past-present-future series, time is continuous, potential, and absolute; but, in regard to the process of becoming, it is epochal, actual, and relative to subjective experience,—taking the form of time-quanta and accounting for the newly discovered indefiniteness in the notion of the simultaneity of events. This ambiguity of concepts is quite confusing, especially when, consulting one of his earlier books, we discover a statement, written perhaps during one of the moments of uncertainty and hesitation, that "time and space, which are entirely actual and devoid of any tincture of possibility, are to be sought for among the relations of events" (*E*, 62). If I misinterpret Mr. Whitehead, let him correct me and throw some much-needed light on the problem, for the obscurity of which he is, no doubt, partly responsible. But it seems to me that his philosophy, as it stands today, brings us, in some respects at least, back to the days of Newton, since it creates, on the one hand, the doctrine of absolute (potential) space-time (extension) and, on the other hand, the doctrine of relative (actual) space and time, the latter being "simply expressions for a certain observed ordering of events" (*R*, 71).

4. Something like a compromise is reached in creating the distinction between "mere" (or "general") and "real" potentiality (*PR*, 123 f.). By the former Whitehead understands "the bundle of possibilities, mutually consistent or alternative, provided by the multiplicity of eternal objects" (*PR*, 102). The latter is consti-

tuted by the physical world, the spatio-temporal field in particular, and is called "real" because of its inherent creativity, and "potential" because of its passive capacity (*A*, 230). Yet I am afraid that the distinction is largely verbal and by no means clarifying. One can comprehend, of course, that the same physical world is actual, in so far as it creates, and potential, in so far as it contains, that which is about to be actualized. But one wonders whether Whitehead seriously means to ascribe inherent creativity and, consequently, real potentiality to the system of spatio-temporal relations called by him extension. The whole thing is egregiously confusing and defies the best effort at comprehension on the part of a reader; and when he, moreover, hears that "the extensive continuum is real, because it expresses a fact from the actual world and concerning the contemporary actual world" (*PR*, 103) and recalls that, in another connection, even the future was called real, obviously on some different grounds yet apparently in the same sense, he is completely bewildered.

5. Furthermore, what is the reason that Whitehead, who seems to endow the "real" potentiality of space with creativity, without adequately discussing the implications of such an assumption, does not consider the other alternative which his initial position suggested, namely, that everything that becomes is actual, whether it be classed as relatum (event) or as relation? In this respect, he, following a long but doubtful tradition, assumes that only relata undergo transformation in becoming. Yet the assumption is questionable if not false. The truth, as I see it, is, first, that no relatum can change without thereby modifying existing relations, and also that no relation can change without thereby modifying existing relata. The dependence of events and relations is mutual and demonstrates their inseparability rather than causal interaction; consequently, both types of existential elements partake equally of becoming. Second, it seems to me that it is a mere prejudice, inherited from old natural philosophy, to believe that the same self-identical space persists through successive moments of time; the physics of four dimensions implies, in fact, that spaces are superseded in process no less than are events. Instead of speaking only of time-quanta, Whitehead should have spoken of space-time-quanta. Third, as soon as we clearly comprehend that space can not undergo change apart from the events bound with it and that it passes with time, just as time passes with space, we arrive at the conclusion that there is no more potentiality for division in the system of spatial relations than there is potentiality for transformation in events. Thus, the problem of process will remain obscure until we carefully examine the distinction between the actuality of events and the

actuality of relations. I do not know to what extent this suggestion of mine entails a revision of Whitehead's philosophy of organism, or in what measure my criticism invalidates it. What I know, is that he made a brave effort to get insight into most profound aspects of the physical and mental world and to integrate his conclusions into a wide and coherent system. It was, however, in the presentation of his philosophy, complicated by a notoriously difficult terminology, that Whitehead failed, making his books the despair of many a curious and serious scholar.

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BOOK REVIEWS

Vers le Concret: Études d'Histoire de la Philosophie Contemporaine. JEAN WAHL. Paris: J. Vrin. 1932. Pp. 269.

Vers le Concret brings together three previously published studies, slightly changed, and unified by a preface: "William James d'après sa correspondance," "La philosophie spéculative de Whitehead" (respectively in the 1922 and 1931 volumes of the *Revue Philosophique*), and "Le Journal métaphysique de Gabriel Marcel" (*Revue de Métaphysique et de Morale,* 1930). The resulting book has, however, nothing of the quality of a collection; it gives, rather, a cross section of certain aspects of contemporary empiricism through a sympathetic but discerning presentation of the views of an American, an English, and a French thinker of diverse backgrounds: James as psychologist, Whitehead as philosopher of the exact sciences, Marcel as dramatist. The studies are ably executed: well written, penetrating, clearly organized, nourished by abundant quotations, and projected against a wide knowledge of past and present thought. Excellent as introductions, the studies could hardly fail to be suggestive to any reader. Thankful for much, one might perhaps wish that Wahl had added a companion study on some German figure, such as Scheler or Heidegger.

Wahl discerns a deep and wide movement toward the concrete along all fronts of contemporary thought, and his juxtaposition of the three figures treated allows certain of the characteristics of this movement to stand out, characteristics which he finds in varying degrees in Alexander, Heidegger, Husserl, Scheler, Hönigswald, Bauch, Kierkegaard, Hartmann, and Bergson, as well as in James, Whitehead, and Marcel. Among points in common to the three thinkers treated the following may be mentioned: the insistence upon the immediate, the given, the concrete, and so upon intuition in the root sense of the word, and upon philosophy as description; the

realization of the structural, the voluminous, the slab-like characters of the immediate; a strong sense of the self as given in a world of things (the *In der Welt sein* of Heidegger) with which it is in sympathetic give and take; man is put *in toto* nature, but nature is reinterpreted in a way much more worth being put into; the bringing into prominence of the categories of feeling, giving consciousness a secondary and derivative place; a sympathetic interpretation of science as an instrument of analysis, but a denial of any materialistic or deterministic implications, or that reality can be exhausted by intellect; a frequent appeal to a mystical supra-intellectualistic absorption in reality, a romantic delight in the richness of the world, and its dangerous and adventuresome qualities; the general recognition of social and organismic categories instead of narrowly individualistic and atomistic ones; a firm appreciation, nevertheless, of the stubborn and insistent pluralistic character of actuality; a strong sense of the body, and so of the significance of biological and psychological concepts, and consequently of development and time; a feeling for the concrete that is more than phenomenalistic, since it includes a strong religious and metaphysical sense and demand; a flair for the openness and novelty of the universe, and of the significance of choice and freedom; an interest not only in the opulence of nature, but in a vital intellectual life, as opposed to what Whitehead has called the celibacy of the intellect; a wide tolerance for diversity of systems, and a deep sensitivity to a multiplicity of influences; and in general a tendency to regard as polar, concepts which had come to function as contradictories: monism and pluralism, continuity and discontinuity, receptivity and creativity, immanence and transcendence, internality and externality of relations, organic and inorganic, mechanism and teleology, Being and Becoming, permanence and novelty, universal and particular, past and future, private and public, subjective and objective, individual and society, positivism and metaphysics, realism and idealism. It would be practically necessary to use both members of these sets of terms to describe Whitehead's philosophy, and to a less degree the same is true for James's.

One gets from the very richness of this wing of the new empiricism a feeling that it is the counterpart of esthetic impressionism. There is also evident something of the rapturous enthusiasm for an endless world opened to the gaze that is highly reminiscent of Bruno, and a good case could be made out for the view that the movement Wahl is tracing has taken up anew the philosophically abortive insight of the fifteenth century which had been shortly buried in the remnants of a scholasticism that had, in Whitehead's terms, led to the assimilation of the "matter" of the new science

with the substratum of the Aristotelian-scholastic tradition. But just as the medieval world was not to be conquered so easily in the fifteenth century, so, too, it would seem that the Brunos of the contemporary world have carried in themselves motives foreign to empiricism, and have taken advantage of the breakdown of older dichotomies to find everywhere everything that is prized. There is a consequent mixing of description and self-confession; a carelessness about methodological considerations; a religio-metaphysical type of construction that is never adequately joined on to the presumed positivism; a blurring of distinctions where the distinctions are not wanted. The fact that the spectrum is in one sense a continuum does not negate the other fact that concepts applicable to one part of the spectrum are not applicable to others. As Wahl says of Whitehead, "perception becomes so natural that all of nature becomes perception," and this sort of conversion does not ring true to one type of empirical mind. It is significant that Wahl does not mention the logical positivists, or pragmatists of the type of Dewey and Mead. If the empiricism sampled in this volume may be said to be tender-minded and to have its natural affiliations with idealism, the companion tendencies of logical positivism and critical pragmatism represent the tough-minded wing of empiricism, with natural affiliations to a realistic attitude and cosmology, in so far as these can themselves be grounded meaningfully on a positivistic basis.

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Sinn und Unsinn. WALTER BLUMENFELD. München: Verlag von Ernst Reinhardt. 1933. 110 pp.

The German word "*Sinn,*" like its English correlatives, "sense" and "meaning," is used in different ways. On this basis the author of *Sinn und Unsinn* distinguishes five types of meaning. These are: (1) Semantic meaning (*der semantische Sinn*); (2) Telic meaning (*der Zwecksinn*); (3) Formal meaning (*der Gestaltsinn*); (4) Logical meaning (*der Begründungssinn*); and (5) Psychological meaning (*der motivationssinn*).

Meaning of the semantic type consists essentially in a not further analyzable relation between a symbol and the object which it symbolizes. This relation is obviously nonsymmetrical and nontransitive. For, if one of two entities is a symbol of the other, it does not follow that this other is a symbol of the one; and, if the former of these is a symbol of the latter and the latter a symbol of a third entity, it does not follow that the first named is a symbol of the third. We observe also that in different languages, and even within the same language, there are many symbols for the same object. Thus seman-

tic meaning is characterized by the property of translatability (*Übersetzbarkeit*).

There is a sense in which semantic meaning is objective. That is to say, the relation between a symbol and that which it symbolizes is independent of any particular apprehension. Yet it is also true that symbols are deliberately employed to convey meaning, to produce a definite activity on the part of another person. There is usually one who "gives" the symbol and another who "receives" it. Thus we are led to our second concept of meaningfulness, the telic or purposive. This is not a relation between a symbol and its object, but between two events or processes, one of which takes place for the sake of the other. The telic relation resembles the semantic in being nonsymmetrical; since if *A* is a means for the achievement of *B*, it does not follow that *B* is a means for the achievement of *A*. Telic meaning is also characterized by the property of non-exclusiveness (*Nichtausschliesslichkeit*); that is, there may be more than one means for the achievement of the same end. Telic meaning, however, does not have the property of translatability. A further point of difference between telic and semantic meaning is that the former is transitive; if *A* is a means to *B*, and *B* is a means to *C*, *A* must be a means to *C*.

With the same technical thoroughness, enlivened by occasional excursions into biology, history, metaphysics, religion, and the philosophy of art, the author proceeds to analyze his third, fourth, and fifth types of meaning. These depend, respectively, upon the relation of a part to its whole, of an assertion to its ground, and of an action to the motives which produce it. On page 67, the points of resemblance and difference of the five types of meaning are exhibited in convenient tabular form. It is thus proved beyond question that the innocent word "meaning" is itself a word of many meanings. One consequence of this fact is that it is extremely hazardous to pronounce anything meaningless or nonsensical; for what is devoid of meaning in one sense of the term may nevertheless possess meaning in some other sense. The moral would seem to be that we should agree to restrict the English word "meaning"—whatever may be done in the case of the German *Sinn*—to the semantic use, or if this is not possible, to the semantic and telic uses.

RAY H. DOTTERER.

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Mencius. Translated by LEONARD E. LYALL. London & New York: Longmans, Green & Co. 1932. xvi + 277.

Mencius was a mind of about the same ability as the Stoic Cleanthes or Epictetus. In China, however, there was no Plato or

Aristotle to overshadow the Confucian school, so that Mencius is of the first importance for Chinese philosophy. His sayings have moreover been carefully preserved and are eagerly studied in China today, whereas the writings of Cleanthes have been mostly lost. The appearance of a new and better English translation of this ancient Chinese philosopher is therefore an important event to everyone interested in the world's philosophies.

Mencius, next to Confucius and Hsüntze, was the most important figure in the development of what came to be the reigning philosophy of China; his democratic tendencies have made him even more popular in republican China today than the aristocratic Confucius or the authoritarian Hsüntze. These sayings, which were probably written down by his pupils under his own supervision, show Mencius to be a master of debate, who used his great abilities to propagate and defend the Confucian teachings. Coming from one of the best families, he refused to bend before any of the princelings and kings who abounded in China of that day, and uncompromisingly preached to them the Confucian teaching that a ruler must govern for the benefit of his people, otherwise he can be rightfully overthrown. This teaching has helped powerfully to make China on the whole the best governed country in the world.

Mencius's chief claim to greatness lies in his defence of the inherent goodness of human nature, that man tends naturally to goodness as water tends to flow downward. Here Hsüntze challenged him, pointing out that such a teaching makes unnecessary any study of the authoritarian Confucian code. Hsüntze instead taught that human nature naturally tends to evil, so that it needs the Confucian teaching to correct its perversity. Chinese public opinion, caught by the flattery of Mencius, has mostly ranked Mencius higher than Hsüntze, but Confucianism adopted the authoritarian teaching of Hsüntze in harmony with its own spirit.

This translation is a great improvement upon the verbose one of Legge, which has been standard for the past sixty-odd years. Mr. Lyall has done Mencius into Anglo-Saxon, and attempted to reproduce the brilliant, concise style of his author. Therein the translation has succeeded remarkably well, considering the extreme difficulty of such a task. Brief notes explaining names and places aid the reader greatly. (A few of the longer notes, containing quotations from Goethe and others, could well have been spared.) This conciseness sometimes however makes for difficulties: for example, the Chinese word, *jen*, is throughout translated by "love"; the translator nowhere explains that this Chinese word does not mean exactly the same as the English "love." *Jen* means rather "kindness"; it denotes the kindly, benevolent attitude of the superior to the in-

ferior; Chinese uses a different word for the love of equals. It is indeed doubtful if any of the Chinese Classics can be made altogether clear without elaborate explanation—something that is not attempted in this book. Mr. Lyall has done about as much as any mere translator can do. The book is well bound, with wide margins; a concordance of subjects and one of names add greatly to its usefulness. For the average reader who knows no Chinese, yet wishes to study the message of this, one of the world's great teachers, the book can be highly recommended.

HOMER H. DUBS.

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Knowledge and Object. EDWARD F. TALBOT, O.M.I., A.M. Washington, D. C., 1932. Pp. 117.

This monograph is an exposition and defence of the Thomistic theory of knowledge.

With the Augustinian-Platonic tradition opposed to him, and with his contemporaries (e.g., Bonaventura, John Peckham, Matthew of Aquasparta) condemning his whole-hearted acceptance of the teaching of Aristotle, St. Thomas set out to elaborate a theory of knowledge on the foundation of the Aristotelian metaphysic, a theory which had been only obscurely sketched by the Stagyrite.

It is not surprising to find great value in a doctrine espoused despite such opposition. Whoever is genuinely puzzled by the problems of knowledge will do well to consult the *Quaestiones disputatae* of Thomas Aquinas. His explanation of the Aristotelian view that *"anima est quodammodo omnia"* and his distinction of that which is known (*id quod*) from that by which (*id quo*) knowledge is possible will enable the student to escape many epistemological pitfalls.

While disclaiming that St. Thomas has said the last word in epistemology, Mr. Talbot supports the Angelic Doctor's theory of knowledge with its metaphysical and theological ramifications in all its minutest details. His work is that of a disciple, and while it exhibits a thorough understanding of the master's teachings, it is singularly uncritical.

Feeling it incumbent upon him to reckon with modern epistemologists, the author falls into facile refutations made possible by a misunderstanding of the positions he criticizes. For example (p. 98):

> Some would have us believe that knowledge is to be judged by a mere pragmatic test, that is, by its value. The hope of truth is entirely discarded. Not *what is true*, but *what is useful* has become the new standard.

This does not fairly represent the position of anybody I know.

Objective relativism is disposed of (without a single reference to Whitehead or Dewey) by a patent *petitio principii* (p. 55):

> . . . this theory teaches that all perceived data from whatsoever "standpoint" are not only attributively but existentially objective. Such being the case the penny not only appears, but actually is both circular and elliptical at the same time. That the penny is viewed from two different standpoints does not change the main contention, namely, that it is the same object of reference, the same penny.

Mr. Talbot might appreciate objective relativism better if he asked himself the question: what shape does the single permanent penny *really* have?

While he was reviewing modern work on epistemology it is unfortunate that Mr. Talbot neglected so important a contribution as C. I. Lewis's *Mind and the World-Order.*

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JOURNALS AND NEW BOOKS

REVUE PHILOSOPHIQUE. 58e Année, Nos. 11 et 12. Lettre sur Heidegger à M. Daniel Halévy: *R. Bespaloff.* L'assimilation et le schématisme: *A. Burloud.* Essai méthodologique sur l'élaboration des faits, doctrines et pratiques de la médecine: *Dr. Téchoueyres.* La force organique et la force cosmique dans la philosophie médicale de l'Inde et dans le Véda: *J. Filliozat.*

SOPHIA. Fonti e Studi di Storia della Filosofia. Anno I, N. 2. Hegel a Roma: *Francesco Orestano.* Storicismo attualista; *Carmelo Ottaviano.* Il problema dell'errore nella filosofia di B. Spinoza: *Adolfo Levi.* L'infinità dell'essere in Melisso di Samo: *Rodolfo Mondolfo.* Il realismo metafisico di Vincenzo Gioberti: *Roberto Pavese.* Le antinomie della Ragion Pura in S. Agostino: *Michele Giorgiantonio.* La dialettica in Anselmo d'Aosta: *Michele Losacco.* Il pensiero filosofico nel "De Trinitate" di S. Agostino: *Primo Montanari.*

Castaner, C.: Soul and Matter. A Systematic Enquiry into Inductive Metaphysics. London: W. J. Bruce, Ltd. 1933. 48 pp. 5s. (A monadic theory synthesizing physics, biology, and neuropsychology.)

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Kœberlé, A.: Nouveau Traité de la Liberté Chrétienne. Justification et Sanctification. Traduit de l'Allemand, *Rechtfertigung*

und Heiligung, par E. Roehrich. Paris: Félix Alcan. 1933. vii + 240 pp. 35 fr.

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NOTES AND NEWS

We print below the program of the Thirty-third Annal Meeting of the Eastern Division of the American Philosophical Association which will meet December 28, 29, and 30, at Amherst College.

THURSDAY, DECEMBER 28

8:00 P.M. Informal Smoker.

FRIDAY, DECEMBER 29

9:30 A.M.
Welcome by Vice-President T. C. Esty of Amherst College
Symposium: "The Status of Mind in Reality"
Charles W. Hendel, Arthur E. Murphy, James B. Pratt

2:30 P.M.
What is Materialism? ..... *Sidney Hook*
Appearance and Orientation ..... *Grace A. de Laguna*
On the Attributes of Material Things ..... *C. J. Ducasse*

7:30 P.M. Annual Association Dinner
Presidential Address: Experience and Meaning ..... *C. I. Lewis*

SATURDAY, DECEMBER 30

9:30 A.M.
Verifiability, Truth, and Verification ..... *Ernest Nagel*
The Conception of the Psyche in Plato's Metaphysics. *Raphael Demos*
The Universe of Light ..... *Frederick J. E. Woodbridge*

2:30 P.M.
The Principles of Evaluation in Æsthetics ..... *A. Myrton Frye*
Political Fictions, Norms, and Postulates ..... *Marie C. Swabey*
The Concept of "Usury"—The History of an Idea..*Carl F. Taeusch*

The Program of the Tenth Annual Meeting of the Pacific Division of the American Philosophical Association which will meet at the University of California at Los Angeles, December 28, 29, and 30, is as follows:

THURSDAY, DECEMBER 28

2:30 P.M.

The Concept of Karma in Vedic Philosophy ..... *E. T. Dana*
(Introduced by J. Loewenberg)
A Critique of Schlick's Claims to Standpointlessness. *P. A. Schilpp*
A Wish Theory of Art ..... *E. A. Robinson*

7:30 P.M.

Worlds in which we Participate ..... *H. B. Alexander*
Concatenation ..... *William Savery*

FRIDAY, DECEMBER 29

9:30 A.M.

Symposium: "Mind, an Event in Physical Nature"
"The Mind's Excursive Power" ..... *G. P. Adams*
The Physical Location of the Cognitive Datum .... *D. C. Williams*
The Recrudescence of *Physics* ..... *W. H. Long*
Discussion ..... *William Savery, H. C. Brown*

2:00 P.M.

Equality as a Moral Value .....*J. H. Tufts*
The Comedy of Immediacy in Hegel's Phenomenology
J. Loewenberg

7:00 P.M. Annual Dinner
Presidential Address: Functional Realism ..... *J. E. Boodin*

SATURDAY, DECEMBER 30

10:00 A.M.

Thought and Analysis ..... *E. W. Hall*
The New Materialism—A Critique ..... *H. L. Searles*
The Self and its Object in Racial Cultures ..... *E. D. Starbuck*

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